Maintenance Schedule

BESS

Maintenance schedule for battery energy storage systems

with LFP battery modules type LF280x

Imprint

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Original document

This document is an original document of FREQCON GmbH.

Target Group

This document is intended for persons responsible for the maintenance of FREQCON Battery Energy Storage Systems.

Display Elements

Symbol	Significance
➜	Action with one or several steps for which the sequence is irrelevant.
Step 1 : **Step 2 :**	Action with several steps for which the sequence is relevant.
•	First level of list.
-	Second level of list.

1.1 Disclaimer of Liability

The contents of this publication have been reviewed to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, any necessary corrections are included in subsequent editions.

2 Maintenance

⚠ DANGER	
	**Hazard by electrolyte** Performing work on the battery storage unit and its components is only permitted for qualified personnel, trained and certified by FREQCON GmbH. It is not allowed to modify or manipulate the battery storage unit and its components. ➜ Do not open, disassemble or puncture the battery modules ➜ Do not short circuit the battery modules ➜ Do not drop the battery modules and avoid vibrations ➜ Do not a use defective or damaged battery modules ➜ Do not a use defective or damaged battery storage unit ➜ Do not touch defective or damaged batteries with bare hands. Defective or damaged batteries must only be handled by FREQCON personnel. **Avoid these dangerous situations, since it may lead to severe injuries or even death!**

⚠ DANGER	
	**Electric shock hazard!** **Always respect all the safety instructions and, in particular:** ➜ Always use protective devices suitable and approved for each type of activity. ➜ The instructions in this manual must be strictly followed. ➜ The electrical connection must be carried out in accordance with the local regulations of the utility company and /or VDE (in Germany). ➜ Use of the equipment must comply with all national and local regulations. ➜ Battery modules must only be accessed after disconnecting the electrical system from all electrical power sources.

The following describes the maintenance work that is necessary for trouble-free operation. Maintenance intervals must be taken into account*(see section 2.3 "Maintenance Schedule* BESS").

If increased wear of individual components or functional groups is determined during regular inspections, the operator has to reduce the required maintenance intervals on the basis of the actual signs of wear. Changes compared to the normal operation (increased power consumption, temperatures, vibrations, noises, etc. or respond of monitoring systems) might indicate the functionality of the device is impaired. These then have to be subjected to an inspection by qualified personnel.

2.1 Preparations Prior Maintenance

The following safety precautions must be carried out before commencing service and maintenance work.

Non-observation of these safety instructions can cause injury to persons, damage to objects or malfunction or damage to the device itself.

Do not operate!	**Lock and tag power switches and controller devices**
⚠ DANGER 	Disconnect power and block operation controller devices. Follow national laws regarding Occupational Safety and Health. 1. Identify the energy source(s). 2. Isolate the energy source(s). 3. Determine voltage-free status. 4. Ground device or equipment to protect from short circuiting and from shocks. 5. Lock and Tag the energy source(s). 6. Prove that the equipment isolation is effective. 7. When required, apply lock-out device or clamp and secure with padlock(s).

2.2 Maintenance Execution

The maintenance work described below may only be carried out by personnel authorized and trained by FREQCON GmbH. The individual maintenance tasks are performed and described during the training. In addition, participants will be given a detailed description of the maintenance work in the form of training documents.

2.3 Maintenance Schedule BESS

The maintenance intervals provided in the following must be adhered.

	Maintenance Instructions	Interval	Hours	Personnel
BESS container exterior	• Visual inspection for external damage, leakage and corrosion • If necessary, seal leaks, touch up corrosion protection • Visual inspection of ventilation, cleaning/replacement of filters and ventilation technology (fans) if necessary. • Checking the lock mechanism for function • Visual inspection of ground connections and measurement of ground resistance • Visual inspection for contamination and cleaning if necessary • Visual inspection of warning and safety instructions • Documentation of damage and activities performed	Annually	2	1
Battery modules and DC cabling	• Maintenance of the storage units according to manufacturer's specifications, visual inspection of ventilation, cleaning/replacement of filters and ventilation technology (fans) if necessary. • Visual inspection for external damage, leakage and corrosion • Testing of terminal points by means of thermography, function control of load-break switches and fuse switches • Visual inspection for contamination/dust and cleaning if necessary • Visual inspection of sensors for tight fit and damage • Documentation of damage and activities performed	Annually	2	1
	• If required or requested, replacement of the battery modules • Visual inspection of mechanical and electrical connections for tight fit, damage, corrosion - If necessary, repair before installing the new battery modules • Visual inspection of the slide rails, the holding frame and the rack system for damage, corrosion - If necessary, repair before installing the new battery modules • Include in overall system documentation	If needed	1 h per module + 1 h setup time	2

Electrical components and cabinet	• Check protective covers and insulation protection for completeness • Perform function test for on/off switch • Visual inspection of the cable fastening for electrical cables and communication cables • Random mechanical testing • Fastening of electrical cables and communication cables; retighten if necessary. • Functional test of fault-current circuit breaker • Check stability of cable ducts • Perform functional test of uninterruptible power supply (UPS), replace if necessary • Checking the server and network components, performing software and security updates, if necessary • Testing according to DGUV for stationary equipment	Annually	3	1
	• Inspect Stat-X aerosol generators for physical damage such as cracks, dents, deformation, or corrosion. Inspect Stat-X aerosol generators for physical damage, such as cracks, dents, distortion, or corrosion. If damage is found, replace generator as instructed in the installation section of this manual. • Inspect mounting brackets, clamps, and associated hardware for loose, damaged, or broken parts. Replace damaged parts and tighten all loose hardware. • Inspect all manual release stations for damage, dirt, or distortion. Inspect station for signs of physical damage, replace if necessary. • Inspect all electrical connections and run electrical continuity tests using an ohmmeter. Repair and replace as necessary.	Every 6 months	0.5/cartridge	1
	• Replacing Stat-X aerosol cartridges (see manufacturer documentation) The aerosol generators have an installed service life of fifteen (15) years. Generators are to be replaced fifteen years from the date code in the lower right corner of the product label.	Every 15 years	0.25/cartridge	1
Converter	• Converter maintenance according to manufacturer's specifications	Annually	3	1
Climate control	• Clean the device • Check for cleanliness and functional capability of the condensate drain • Check fans for overheating and unusual vibrations and whether they rotate freely • Check heat exchanger for contamination and effectiveness • Check refrigeration circuit for leakage, check pressure switch and refrigerant indicator • Check condition of filters - cleaning or replacement if necessary. • Check all electrical connections • Perform function tests for all switches and the control board, perform alarm signal test	Annually	1	1

Table 1: Maintenance schedule BESS

2.4 Visual Inspection

For functional and safety reasons, the customer is responsible that regular inspections of the BEES and its operating environment are carried out.

The following needs to be inspected/performed at least every six (6) months:

- ➜ Visually check for external signs of damage. Consult your authorized FREQCON representative if any damage is detected.
- ➜ Open the doors of the rack/front lid of the cabinet and visually check for signs of electrolyte leakage or any other deviation from normal conditions. Consult your authorized FREQCON representative if any leakage etc. is detected.
- ➜ Check that the cable connectors look undamaged and that the battery packs are properly positioned on the shelfs.
- ➜ Check for any deviation from normal conditions in the BMS (look, listen and smell). Consult your authorized FREQCON representative if any deviation is detected.
- ➜ Check general appearance and cleanliness. If necessary, clean by using a dry cloth.